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Political determinants of electricity provision in small island developing states

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HIGHLIGHTS

- Effects of political institutions on household electricity consumption in SIDS.
- Electrification is seen as an example of public good provision.
- Democracy has a positive impact on electricity consumption when corruption is low.
- Electrification projects can gain from being sensitive to institutional context.

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ABSTRACT

This paper approaches provision of affordable and reliable electricity in Small Island Developing States (SIDS) as a case of public good provision. It aims to contribute to our understanding of how regime type and the quality of implementing institutions within political systems affect the prerequisites for successful electrification in SIDS. More specifically, we analyse the independent and interdependent effects of level of democracy and control of corruption on per capita household electricity consumption in SIDS, using data from 34 SIDS over the period 1996–2009. The results show that although the independent effects of level of democracy and control of corruption are sensitive to model specification, these two factors do have an interdependent impact on per capita household electricity consumption: democratization has positive effects on provision of electricity to the general population only when there is a certain level of corruption control in place. The results imply a) that it is important for policy actors to acknowledge the interaction between regime type and the quality of implementing institutions, and b) when planning electrification projects in SIDS, it is necessary to have information about the social and political context in order to design the most effective projects.

1. Introduction

In line with the UN Sustainable Development Goal 'ensure access to affordable, reliable, sustainable and modern energy for *all*' (United Nations, 2015b [italics added]), this paper approaches provision of affordable and reliable electricity in Small Island Developing States (SIDS) as a case of public good provision. By this, we mean that the benefits of providing access to affordable electricity are non-excludable and 'non-rivalrous' (e.g. street lights, reliability) indicating a limited incentive for individuals or the private sector to contribute to their production (e.g. Abbott, 2001). The building of large-scale transmission and distribution infrastructure is hugely expensive and a long-term investment, thus typically of little interest to commercial investors. Hence, the undertaking of electrifying an entire population is primarily politically driven (Baskaran et al., 2015), posing high demands on both the political and administrative systems (Ahlborg et al., 2015).

One of the central debates in research on the drivers behind public good provision concerns what kinds of governments–democratic or autocratic–most effectively provide public goods, such as basic infrastructure and social services. Clearly, democratic institutions–through which the leaders of a country are held accountable to the citizens–create a strong incentive among leaders to deliver generally demanded public goods, including affordable electricity (Acemoglu and Robinson, 2006; Schmitter and Karl, 1991). Because elections provide citizens with the power to replace leaders that do not fulfil these expectations, and because public good provision is likely to be included in the evaluation of political leaders, democracy can be expected to lead to more public good provision, such as affordable and reliable electricity in SIDS

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countries (Bueno de Mesquita et al., 2003; Deacon, 2009; Gandhi and Przeworski, 2006; Lake and Baum, 2001; McGuire and Olson, 1996).

In parallel, however, a growing literature questions the significance of these parameters (such as free and democratic elections), instead arguing that successful provision of public goods is determined by the quality of a number of other parameters, i.e. the institutions responsible for *implementing* public good policies. One common argument is that elected leaders often work with short time horizons (Haggard, 1991; Keefer, 2006) whereas public good provision–not least in the form of investments in electric power infrastructure–is a long-term undertaking (Min, 2008, 2015). Furthermore, the focus on accountability and incentive structures for political leaders tends to overlook situations where political leaders have strong incentives to provide public goods (e.g. because they want to be re-elected) but lack the *capacity* to deliver them, typically due to a poorly functioning central bureaucracy (Ahlborg et al., 2015). One key factor that has been shown to affect public service provision is the presence or absence of corruption, conventionally defined as the exercise of public power for private gain (Gupta et al., 2000; Holmberg et al., 2009; Mauro, 1998; Nye, 1967).

In this paper, we study both the independent and the interdependent effects of democracy and corruption on the provision of electricity to households.

When studying the impact of democracy and corruption on public good provision, studying SIDS is of particular interest. It is commonly argued that public good provision has increasing returns to scale, which, in the case of small islands, means that they risk suffering from higher per capita costs for such public goods. In addition, countries in this group are vulnerable to natural disasters and particularly dependent on external support and/or international trade, which makes the provision of electricity and other public goods especially challenging.

Based upon this short background, the aim of the paper is twofold. First, we briefly assess how successful small island developing states are when it comes to public good provision in the form of affordable and reliable electricity. Second, and primarily, we examine the effect of the level of democracy and control of corruption in the public administration on successful provision of electricity in SIDS. As we argue below, there are strong reasons to expect that these factors can reinforce each other's effect on public good provision. Therefore, we study both their independent and interdependent effects.

This paper thus contributes to the energy policy literature in several ways. First, it offers a comparative analysis of provision of electricity to the general public in SIDS. Second, and most importantly, it contributes to our understanding of how regime type and the quality of implementing institutions within political systems affect the prerequisites for successful electrification in SIDS. Furthermore, to understand better how these institutional features are related to provision of electricity in the SIDS's context is of utmost importance for policy, because to design the most effective projects, it is crucial to know the challenges of the specific context. Policies aimed at fulfilling the general demand for electricity most likely need to be rather differently designed depending on the political and institutional contexts. For example in contexts lacking a democratic tradition, or contexts suffering from severe corruption, electrification projects are likely to need a strong focus on the institution building to be successful (Ahlborg, 2015). Previous research also shows that policy instruments have to be sensitive to the political institutional context to be seen as legitimate (Harring, 2014, 2015).

The rest of the paper is organized in the following way. First, we briefly discuss previous research on SIDS and public good provision. In this section, we also account for previous research on how regime type and the quality of implementing institutions impact public good provision. Building on these lines of research, we present our argument and hypotheses. Thereafter, we account for our methodological approach, describing the data we use and the statistical techniques we apply. A section where we present and discuss our results then follows. The paper ends with a discussion of policy implications and some concluding remarks.

2. Background and literature review–hypothesising successful electrification

2.1. SIDS and the need for electricity

SIDS is a rather diverse group of slightly more than 50 countries. To call them SIDS is not all that straightforward. First of all, not all SIDS are small: their populations vary from six thousand people in Nauru to 11.5 million in Cuba, while land area varies from Tuvalu's 30 square km to 452,860 square km in Papua New Guinea. Second, not all of them are islands, as some are located on a continent, such as Guinea-Bissau, Guyana or Suriname. Third, not all of the SIDS are developing countries. For example, GDP per capita in Singapore reaches 50,000 USD per capita, while in Trinidad and Tobago, Bahamas, Seychelles and Barbados, per capita income exceeds 30,000 dollars, which is comparable to the levels of France and Japan. Finally, not all SIDS are independent nation states. Fourteen of them are territories under foreign jurisdiction, for example American Samoa (the US), Aruba (the Netherlands) and French Polynesia (France). However, what clearly unites these countries and territories is that they all have vulnerable environments and to some degree face similar challenges of limited resources and excessive dependence on foreign trade. We delimit our study to only independent states and governments as they are responsible for taking care of the countries' territories and are fully accountable for their social and economic outcomes.

A focus on SIDS is particularly interesting for the study of public good provision because a rather large literature argues that island states suffer from their smallness and isolation. For example scholars have asserted that public good provision is typically characterized by increasing returns to scale and, hence, that small states suffer from higher per capita costs of such goods (Alesina and Spoalare, 1997; Easterly and Kraay, 2000; Harden, 1985; Kuznets, 1960). Small states may also face disadvantages in terms of diversifying their production, having a limited labour force and facing difficulties in recruiting high-quality candidates (Armstrong and Read, 1998; Briguglio, 1995). In addition, they are vulnerable to and thought to suffer from their remoteness, having high transportation costs, small internal markets and a high degree of vulnerability to economic shocks and natural disasters (Srinivasan, 1986).

This vulnerability is also manifested in regard to electricity provision, which is currently mainly based upon fossil fuels (Dornan et al., 2015). The economies of many SIDS are energy intensive, i.e. the countries consume a large amount of energy for every dollar of income that they generate (Dornan, 2015). Furthermore, due to their distance from major markets, combined with the absence of scale economies, many SIDS are dependent upon long way transportations (Winters et. al. 2004). In addition, a large amount of the unreliable fossil fuel based energy is used for activities that presuppose durable and stable electricity provision, such as for industry and tourism, refrigeration, lighting, and household appliances including air conditioning (World Bank, 2014; Dornan, 2015).

2.2. Public good provision and the importance of a third party

The scholarly community has suggested a multitude of reasons–historical, financial, political, social and technical–behind the energy situation in various developing countries (e.g. Eberhard et al., 2011; Khennas, 2012; Sokona et al., 2012). In this regard, institutional aspects have received significant attention both in terms of country-specific and regional institutional drivers and barriers to increased electricity access. Furthermore, the importance of 'effective, accountable and inclusive institutions at all levels' is also emphasized in the Sustainable Development Goals Goal 16 on peaceful and inclusive societies (United Nations, 2015a).

Less attention has, however, been paid to the very *characteristics* of electricity. On the one hand, electricity is typically seen as a private good constituting a hotbed for a market among those who can provide the goods and those who have the capacity and willingness to pay and where the price is eventually determined by demand and supply. Needless to say, where electricity is scarce, the price in a private, unregulated market will be relatively high and the electricity thus only available to a few. When the goal of electrification instead is to provide access to affordable and reliable electricity to wide segments of the population–which demands e.g. long-term investments in distribution infrastructure–this goal is unlikely to be met in a private and unregulated market. In this particular case, electricity should not be seen as a private good, but rather as something non-excludable and 'non-rivalrous', which is the very definition of a public good (e.g. street lights and a widely distributed infrastructure). This situation is characterized by a limited incentive for individuals or the private sector to contribute to their production (e.g. Abbott, 2001). Thus, when we here talk about electricity distributed to the general public, we perceive electrification in SIDS as a case of public good provision. The building of large-scale transmission and distribution infrastructure is namely hugely expensive and a long-term investment, thus seldom of any significant interest to commercial investors (Baskaran et al., 2015). Rural electrification is particularly expensive in places with difficult terrain, dispersed settlement and/or low population density. For these reasons, national electric utilities have historically been reluctant to extend electricity services to rural areas. Affordable rural electrification has been achieved in most countries through special national programs and funding arrangements, including the use of subsidies (Zomers, 2003). This also points to how politicians determine patterns of electricity consumption not only through the building of infrastructure, but also through, for example, subsidies, price regulation, and other regulatory structures (Brown and Mobarak, 2009). Hence, the undertaking of electrifying the entire population is primarily politically driven, posing high demands on both the political and administrative systems and where a *third party,* i.e., *a* public authority–typically the State–is needed to co-ordinate any targeted goals. This brings us to what properties of this third party are most relevant to consider: its characteristics in terms of regime type, i.e., the procedures constituting the authority, or its characteristics in terms of institutions implementing the authorised decisions.

2.3. Hypothesising the effect of third party-characteristics on electricity provision in SIDS

A common argument in the literature on public good provision is that a country's level of democracy has a strong impact on the extent to which public goods are delivered. Democratic institutions–through which the leaders of a country are held accountable to the citizens–create a strong incentive among leaders to deliver public goods that are in high demand (Acemoglu and Robinson, 2006; Schmitter and Karl, 1991). Because democratic elections provide citizens with the power to replace leaders that do not fulfil expectations regarding the provision of public goods, and because this provision is likely to be included in the assessment of political leaders, democracy can be assumed to lead to more public good provision (Deacon, 2009; Lake and Baum, 2001; McGuire and Olson, 1996).

There are some empirical studies supporting the argument that provision of electricity services indeed matters for citizens' evaluations of political leaders. Chhibber et al., (2004) show that electricity tend to be among the top priorities of voters in the case of India. This is something that political leaders are well aware of and use in their campaign strategies: using a quasi-experimental design, Baskaran et al., (2015) show that state governments in India use manipulation of the power supply as an electoral strategy, and especially so in contested constituencies.[1] Although these studies come from one specific context, we could expect similar processes in other contexts where a) politicians are evaluated in elections and b) a reliable electricity supply cannot be taken for granted, as is the case in many SIDS.

Clearly, governments also in authoritarian or semi-authoritarian states face pressure to provide public goods such as electricity.[2] Still, it can be expected that democracy to a *higher* degree works in the interest of the majority (i.e. the rural population) since a larger portion of the citizenry is included in the political process, whereas authoritarian regimes usually need support from a narrower group (Bueno de Mesquita et al., 2003; Gandhi and Przeworski, 2006). Moreover, regularly held free and fair elections make it more likely that the provision of public goods that citizens demand is a matter constantly present on the political agenda. Thus, it is a reasonable expectation that all else equal, the link between public demand for public goods and provision of such goods should be stronger and more direct in democracies as compared to autocracies.

There are some examples of studies that discuss democracy in relation to energy provision. For example, although primarily concerned with how the share of electricity consumption differs between the residential sector and the industry sector depending on regime type, Brown and Mobarak (2009) nonetheless find some support for this argument. At least among the poorest countries in their data set, democratic governments tend to increase the residential sector's share of electricity consumption relative to industry's share, thus indicating a positive relationship between democracy and provision of electricity to the public. Based upon analyses of satellite night-time images, Min (2015) detects a positive relationship between electoral accountability and share of population in lit areas. In addition, Ahlborg et al., (2015) present results linking level of democracy (as well as factors relating to the quality of implementation processes) to household electricity consumption in African countries. To our knowledge, however, the argument that democracy has a positive effect on energy provision has not been tested in relation to SIDS. Therefore, the first hypothesis to test is the following:

[1] It should be mentioned that Baskaran et al., (2015) find that the increase in electricity supply is due to diversion from other constituencies rather than to the creation of additional electricity. This suggests that increased public good provision should be more likely when diversion is not a fruitful electoral strategy; for example in central government elections. To investigate this is, however, beyond the scope of this paper.

[2] For example, in Nigeria (which is classified as "partly free" according to Freedom House, 2016), power supply recently featured as the most important area for the government to focus on according to surveyed Nigerian citizens (NOIPolls, 2015).

H_1. : The more democratic a SIDS is, the higher is per capita household electricity consumption.

While the literature on democratic accountability and public good provision adds to our understanding of how the incentives of policy makers are shaped by democratic institutions, it has less to say about the ability of political leaders to *deliver* the things they intend to. To understand this better, we must shift our focus to the implementation apparatus within a polity.

Despite strong theoretical reasons to expect a positive effect of democratic institutions on public good provision, a growing literature argues that democratic institutions alone are no guarantee for successful public good provision. There are several reasons for why this might be the case. For example, elected leaders often work with short time horizons (Haggard, 1991; Keefer, 2006) whereas public good provision–not least in the form of investments in electric power infrastructure–is a long-term undertaking (Min, 2008, 2015). Furthermore, the focus on accountability and incentive structures for political leaders tends to overlook situations where political leaders *wish* to provide public goods but *are not able* to do so. In addition, numerous studies show how corruption and clientelistic practices (i.e. the exchange of goods and services for political support) can undermine governments' performance also in cases where democratic institutions are in place (Bratton and van de Walle, 1994, 1997; Chandra, 2004).

Based upon this line of reasoning, we suggest that the focus on democracy should be complemented with the performance of the implementing side of the third party–i.e. the quality of the public administration. In other words, political decisions have to be backed up with an institutional framework that implements policy in an effective and efficient way. One key characteristic of the administration that has been shown to have strong implications for public service provision is the level of corruption, conventionally defined as the exercise of public power for private gain (Gupta et al., 2000; Holmberg et al., 2009; Kaufmann and Kraay, 2002; Mauro, 1998; North, 1990; Nye, 1967).

There are several ways in which the level of corruption could have an impact on public good provision. First, it can have direct effects on public good provision as implementation becomes inefficient and resources are lost through corruption. For example, the literature on rural electrification in developing countries has identified poor organizational structures and corruption as some of the barriers to successful electrification (e.g. Ahlborg and Hammar, 2014; Jones and Thompson, 1996; Karekezi and Majoro, 2002). What these findings suggest is that not only investments are needed in improved generation capacity and expansion of large-scale grid infrastructure, but that investments in well-functioning and adequate institutional frameworks and organizations seem to be equally important prerequisites for effective electricity provision at the household level.

Second, institutions can also have an indirect effect on public good provision in that they influence both the confidence that people have in the implementing agencies, and levels of generalized trust in society (Rothstein, 2011). In other words, trustworthy public administration systems, with a positive 'history of play' (Acemoglu and Robinson, 2006) can be expected to influence positively the ability of agencies to provide public goods, not least through their impact on the ability to build consent regarding the collection of taxes and other contributions.

As we see it, this line of reasoning corresponds with those scholars arguing that regardless of whether a country is democratic or not, the implementing public administration, is crucial (Boix et al., 2003; Rothstein, 2011; Rothstein and Teorell, 2008). Consequently, according to, e.g. Rothstein (2011), it is the presence of corruption and poor government effectiveness that explains social performance rates and not the level of democracy.

Proceeding from this rather broad literature on the quality of public administration, the following hypothesis can be formulated:

H_2. : The higher the control of corruption (i.e. the lower the level of corruption) a SIDS has, the higher is the per capita household electricity consumption.

However, there are also strong reasons to believe that control of corruption not only has an independent effect, but that it also has consequences for the effect of democracy. Democracies are by no means free from the problems of corruption; rather it is an important part of the 'bad governance' that has been called 'a spectre haunting democracy in the world today' (Diamond, 2007). Above, it was argued that even if democratic elections should provide leaders with incentives to deliver public goods, there are circumstances under which it is very difficult to provide those goods. Under such circumstances–such as when the implementing institutions are ridden with corruption–democracy can be expected to have a smaller, or even non-existent, effect on public good delivery. Thus, our third hypothesis is:

H_3. : The effect of democracy on per capita household electricity consumption depends on the level of corruption in SIDS. The less control of corruption a SIDS has, the less positive impact does the level of democracy have on per capita household electricity consumption.

3. Methodology

We first present some descriptive statistics over the provision of public access to electricity in SIDS compared with the rest of the world. In doing this, we compare the means of per capita household consumption of electricity between SIDS and non-SIDS.

We then explore electricity provision in different political contexts in SIDS and estimate how the interplay between democracy levels and institutional quality in SIDS is related to electricity provision to households. We make use of the data available for countries over time, rather than simply relying on cross-country estimates, to increase our sample size and to be able to analyse changes within countries across the available years. We use fixed effects estimation technique, which recognizes the hierarchical structure of the data and analyses developments over time within states. Instead of relying on cross-country correlations, it provides estimates based on the analysis of the changes within countries and therefore brings us closer to capturing the causality between the factors.[3] The fixed effects model assigns a separate intercept for each country and therefore controls for all differences between the states. Thus this technique helps to minimize the unobserved heterogeneity problem by accounting for all time-invariant factors. The model can be summarized in the following equation:

$$y_{it} = \beta_i + \beta_1 x_{it} + e_{it}, \quad (1)$$

where i stands for country, t the year, β_i is the intercept for each country, x is a vector of independent time-varying variables, while e is an error term.

4. Data

The dependent variable in our statistical analysis is annual household electricity consumption per capita (kWh per capita/

[3] To come closer to establishing causality, we should have ideally lagged our independent variables. However, the data does not allow for that, due to the relatively few number of observations.

year). Data for household electricity consumption come from the Energy Statistics Database provided by the United Nations Statistics Division Database (United Nations, 2013). Because we approach electricity provision as a case of public good provision, it is required that the dependent variable measures the degree to which electricity becomes a real 'good' to the general population. In developing countries, low quality and reliability can often hinder translating access into real use. Thus, a statistical investigation of electricity provision as a case of public good provision requires that the dependent variable measures the degree to which the general population not only have access to the grid but actually can benefit from electricity. We therefore study not only *potential access*, but also actual *use* of electricity. This is the main reason why we do not use the more commonly employed measures of access rates–defined as the share of population with access to electricity from national grids–as our dependent variable. Having access to the grid is not enough for benefiting from electricity. If there are many blackouts, access to the grid is not worth much. This has also been acknowledged in a recent report by the International Energy Agency (IEA) and the World Bank, in which it is argued that binary measures of presence or absence of a connection need to be complemented with other aspects, including affordability, reliability and quality (International Energy Agency (IEA) and the World Bank, 2015). Awaiting improved metrics on real electricity access, we therefore rely on the measure of household consumption as a proxy, since when supply is expensive, unreliable, and of low quality, this will impact on average household consumption levels. The advantage of our dependent variable, compared to connection rates, is that it measures how access translates into real use, rather than just availability of distribution infrastructure (for a more detailed discussion of the dependent variable, including a comparison with alternative measures, see Ahlborg et al., 2015).[4]

Our data are covering total household electricity provision without distinguishing whether the provider is public or private. However, previous research states that most electricity provision in SIDS and other developing countries tend to be arranged by the government (Lal, 2005). Based on previous research on SIDS, we can expect that the share of private providers will be small [5] (Dornan, 2014) and is therefore likely to create additional noise in the data rather than affect the results in any substantial way.

The main independent variables are level of democracy and control of corruption. We measure democracy with the imputed Freedom House/Polity IV index, developed by Hadenius and Teorell (2005).[6] The index is a calculated average of two widely used democracy measures: Freedom House democracy score and Polity IV index (Marshall and Jaggers, 2002). For countries and years where data on Polity IV are missing, the index contains imputed values calculated by regressing Polity on the average Freedom House indicator. Hadenius and Teorell (2005) show that the average index performs better in terms of validity and reliability than each of the indices separately. The index ranges from 0 to 10, where the score of 10 corresponds to the most democratic regimes.

The second main independent variable is Control of Corruption taken from Worldwide Governance Indicators developed by the World Bank (Kaufmann et al., 2010).[7] Control of Corruption measures perceptions on the extent of corruption in countries, defined as the exercise of public power for private gain. The Worldwide Governance Indicators are based on several hundred individual variables measuring perceptions of governance, and reflecting the views of a diverse range of stakeholders, including public, private, and NGO sector experts. The specific indicators comprising the index range from perceptions of the frequency of 'additional payments to get things done', effects of corruption on the business environment and 'grand corruption' or 'state capture' (Teorell et al., 2014). Observations are available from 1996, with some gaps in the series during earlier years. The indicator ranges from −2.5 to 2.5, where higher values correspond to lower corruption.

Aggregate measures based on expert and public opinion surveys are not unproblematic. An inherent problem with measuring social science phenomena is an overlap in the concepts, which is difficult to disentangle in survey questions. The fact that the indicators are exclusively based on subjective (perceptions-based) data is also a source of criticism. Still, in many instances there are no objective measures available, and/or the objective measures tend to capture de jure governance rather than de facto governance (see Kaufmann et al., 2009). While having its limits, these indices help to examine general patterns, which opens up opportunities for future research on the more specific factors in play.

In the analysis, we control for several important factors influencing electricity provision to households. First of all, we include the measure of GDP per capita taken from Penn World Table (Heston et al., 2012), as more financial resources allow for the building of more grid lines and can potentially increase household consumption of electricity. GDP per capita can also serve as a control for people's lifestyles, where higher income provides opportunities for higher electricity consumption. In addition, we add a variable measuring population size, taken from the Maddison-project (Bolt and van Zanden 2013), and population density, as it is easier to provide access to a densely living population. The population density measure is taken from the World Bank's Development Indicators (World Bank, 2013, 2014). Data for all of the independent variables are obtained from the Quality of Government Institute (QoG) database (Teorell et al., 2014). We also control for eventual trends in the data by including year as an independent variable.

After combining indicators into a single dataset, the time period for which data becomes available covers the years 1996–2009 over 34 small island developing states.

In our models, we use robust clustered standard errors to account for the hierarchical structure of the data and accommodate heteroscedasticity. Model diagnostics showed that our data are stationary. We also made sure to meet the required assumption that residuals are normally distributed. This required logarithmic transformation of highly skewed variables: household electricity consumption per capita, GDP per capita, population size and population density. We also check our regressions for multicollinearity and do not find that this is a problem in our models.

5. Results and discussion

5.1. Results

The supply of electricity in SIDS is considerably lower than in

[4] In addition, there are well-known reliability problems with the IEA data on access rates. The definition of access is not strictly applied; data are compiled from different sources and self-reported by countries (International Energy Agency (IEA) and the World Bank, 2015; Min, 2015). The household consumption data is moreover available for more countries and years than the EIA data series for access rates.

[5] For example, in Fiji, the share of private electricity providers in total electricity supply does not exceed 5% (Dornan, 2014).

[6] The values for later years are imputed using the same methodology originally suggested by researchers and published in Quality of Government Dataset (Teorell et al., 2014).

[7] We also considered using an alternative measure of corruption, offered by the International Country Risk Group (ICRG, 2014). However, the coverage of SIDS countries by ICRG data is rather limited (the data are only available for 11 countries), which makes regression analysis problematic.

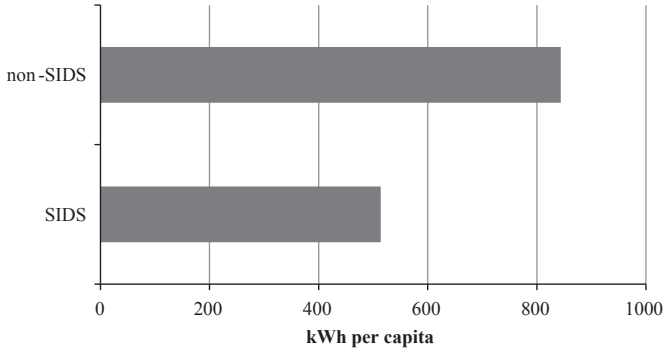

Fig. 1. Per capita household electricity consumption (kWh) in SIDS.

the rest of the world. The average of household electricity consumption is 513 kWh per capita[8] compared to the world's average of 845 kWh per capita (see Fig. 1). There is a big variation within the group of small island developing states, however. Appendix A shows the developments within the most and least successful countries in the SIDS group in terms of electricity provision.

To understand the political context where energy provision takes place, we explore the levels of democracy and corruption control in our SIDS sample. Most SIDS are democracies and only four of them can be classified as authoritarian regimes–Bahrain, Singapore, Cuba and Fiji. They also vary greatly in the levels of corruption. While some of them have strong corruption control, such as Antigua and Barbuda, Bahamas and Singapore, others, including Belize, Haiti and Fiji, suffer from the lack of it. Fig. 2 plots countries according to their levels of democracy and Control of Corruption, while Table A.1 in Appendix A provides a classification of countries. In Fig. 2, we can see that the SIDS in our sample follow a pattern found in previous research on democracy and good governance (including control of corruption) in that the relationship between democracy and corruption is curve-linear. This relationship has been described in various empirical studies as U-shaped, J-shaped and sometimes S-shaped (Bäck and Hadenius, 2008; Charron and Lapuente, 2010; Montinola and Jackman, 2002; Sung, 2004). This points to how a governments' incentives to provide public goods (due to democratic accountability mechanisms) may not always develop in tandem with its ability to do so.

Before moving to a more thorough test of our hypotheses, we first examine the correlation between our dependent and independent variables among SIDS using cross-country scatterplots.

Our first hypothesis suggests that there is a positive relationship between level of democracy and household electricity consumption. Fig. 3 shows that the relationship between democracy and per capita electricity consumption in SIDS in fact is non-linear. While there is a positive effect of level of democracy once countries get over a certain threshold of democracy, some authoritarian states provide higher electrification than some democracies, and democracy is not a sufficient condition for the provision of electricity to households. This is in line with the discussion above about the complex relationship between democracy and control of corruption. It also invites us to explore the quadratic relationship further and turn our attention to the implementing side of the political system; more specifically, we will investigate the relationship between control of corruption and household electricity consumption.

[8] We exclude Bahrain from the average, as due to oil revenues the country has much higher level of household electricity consumption than the rest and therefore biases the data upwards. With Bahrain included, the SIDS average is 670 kWh per person. In the regression analysis later on, we run the models both with and without Bahrain in the sample, and the results are robust to these different specifications.

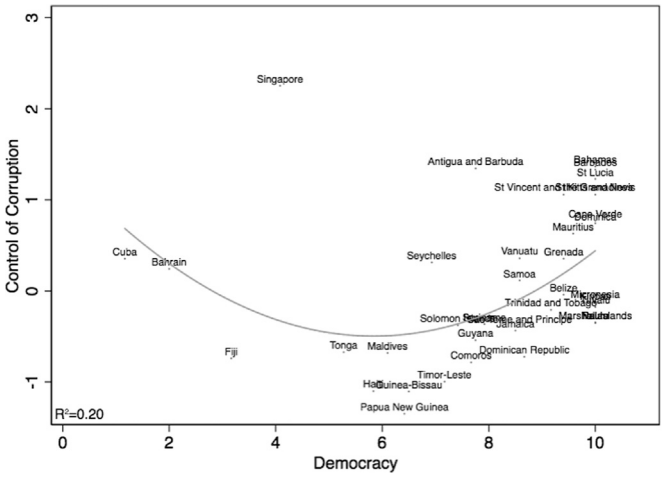

Fig. 2. Democracy and control of corruption in SIDS.

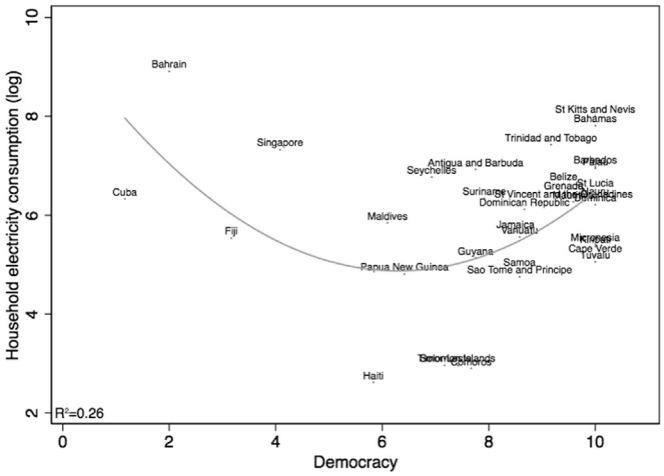

Fig. 3. Democracy and household electricity consumption in SIDS.

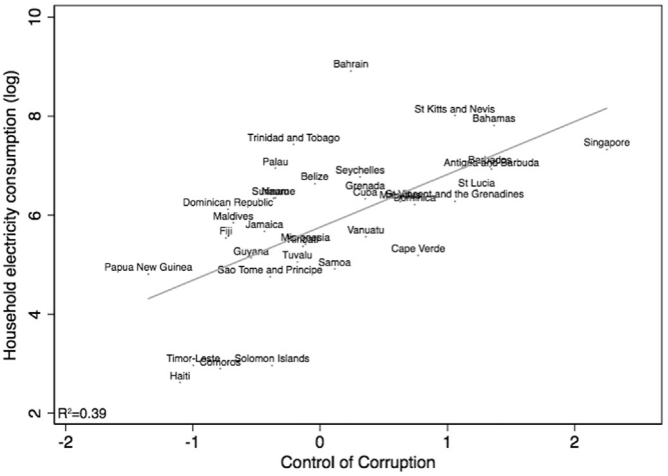

Fig. 4. Control of corruption and household electricity consumption in SIDS.

In the next step, we thus explore whether control of corruption in SIDS can be a stronger predictor of household electricity consumption than democracy. This we do by creating a cross-country scatterplot (Fig. 4) that displays t he relationship between control of corruption and household electricity consumption. Indeed, control of corruption turns out to be a stronger predictor of electricity provision than democracy, with the R^2 value being 0.39 compared with 0.26 in Fig. 3.

Table 1
Democracy, control of corruption and household electricity consumption in SIDS.

VARIABLES	Model 1	Model 2	Model 3	Model 4
Democracy	0.082		0.049	–0.043
	(0.143)		(0.136)	(0.075)
Democracy^2	–0.003		0.001	0.004
	(0.012)		(0.011)	(0.006)
Control of Corruption		–0.106	–0.151	0.196
		(0.124)	(0.124)	(0.199)
Control of Corruption × Democracy				–0.230**
				(0.077)
Control of Corruption × Democracy^2				0.021**
				(0.006)
GDP per capita (log)				0.357
				(0.265)
Population size (log)				0.198
				(0.533)
Population density (log)				1.437*
				(0.642)
Year				–0.000
				(0.014)
Constant	5.357***	5.787***	5.318***	−4.996
	(0.467)	(0.014)	(0.442)	(23.203)
Observations	344	344	344	342
R^2	0.014	0.013	0.036	0.396
Number of countries	34	34	34	34

Robust standard errors in parentheses,
* p < 0.05.
** p < 0.01.
*** p < 0.001.

In Figs. 3 and 4, we account for correlations between our main independent variables and per capita electricity consumption in a cross-country setting. To determine the effect from each of the political factors in a dynamic model, we turn to the help of within-effect regressions in accordance with Eq. (1) and analyse the relationships over time. This is a very strong test of the hypotheses, because only the within-country variation over time is taken into account while the cross-country variation is controlled for. We run the regressions stepwise, starting from bivariate relationships and adding control variables later on. As the effect of democracy on household electricity consumption is non-linear, we explicitly model it in the ordinary least squares analysis by including squared terms of the democracy variable.

Table 1 presents the results from Eq. (1).[9] Model 1 shows a bivariate relationship between democracy and household electricity consumption per capita, while Model 2 presents the bivariate relationship between control of corruption and our dependent variable. As shown in Table 1, when we consider only the within-country variation over time (and thus disregard the cross-country variation explored in Figs. 3 and 4) there are no significant independent effects of level of democracy and control of corruption. Unsurprisingly, this is also true when we add them together in Model 3. These findings do not lend support either to hypothesis 1 or hypothesis 2 and imply the absence of independent effects. Although we could observe from the scatterplots in Figs. 3 and 4 that there are significant relationships in the cross-country sample (although the relationship between level of democracy and electricity was shown to be non-linear), these relationships do not hold when we study changes over time, and control for differences between the states. As we believe that the lack of independent effect can be caused by the missing interaction term in the model, we proceed by testing the interaction effect, while adding a set of relevant control variables into the analysis.

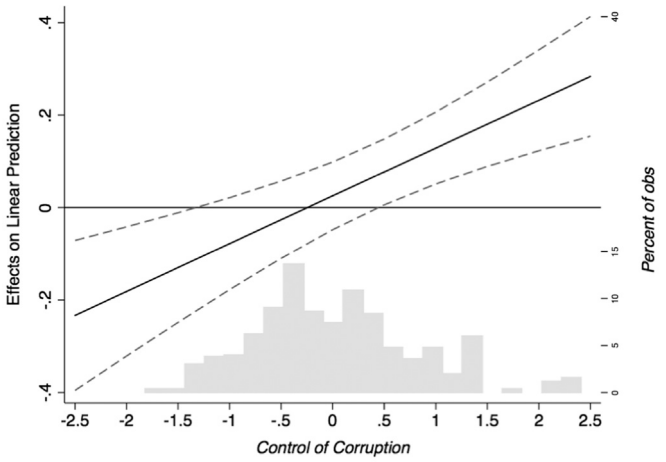

Fig. 5. Conditional marginal effects of democracy on per capita household electricity consumption in SIDS.

Our third hypothesis suggests that there is an interdependent relationship between democracy and control of corruption in their effect on per capita household consumption of electricity. This hypothesis is tested in Model 4, where we introduce the interaction effect between democracy and control of corruption, controlling for the selected factors.[10] Model 4 shows that in line with our third hypothesis, democracy and control of corruption together have an interdependent effect on household electricity consumption. R^2 is rather high. It shows that the chosen model explains almost 40% of the variance in the dependent variable. However, it is difficult to interpret the coefficients from an interaction model directly. To facilitate the interpretation of the results in Model 4, we built a margins plot (see Fig. 5) that illustrates the interdependent relationship. The plot relies on calculated predictive margins that identify at which values of corruption control the effect of democracy on electricity consumption becomes significant.

The margins plot in Fig. 5 shows that democratization indeed has a positive effect on household electricity consumption only when corruption control has reached a certain level (higher than 0.5 on a −2.5 to 2.5 scale),[11] and its effect becomes stronger as the control of corruption rises. When control of corruption is very low (below −1.5

[9] In Table 1, the full sample of SIDS is used. We also ran the models excluding Bahrain, because it is an outlier in terms of electricity provision (table not shown), and the results remain robust.

[10] During model selection we also included two additional control variables: the number of disasters happening in the countries per year, as they can have disruptive impacts on electricity supply, and the amount of foreign aid that the countries receive per year. The latter control variable we included as financial support may help countries get resources for building grids. In doing that, we find that neither the number of disasters, nor the amount of foreign aid seem to be associated with electricity consumption, as their effects on our dependent variable are not statistically significant. At the same time, our main findings remain robust. Therefore, we have opted for not including these control variables into the final reporting of the results.

[11] This level can be comparable with the level of corruption control in Italy and Hungary in 2003.

on a −2.5–2.5 scale),[12] democratization can even lead to lower rates of electrification. This effect is very small, however, which can be due to relatively few cases in the sub-sample.[13] These findings lend support to our third hypothesis, that the effect of democracy is conditional on the level of corruption control in SIDS.

5.2. 2. Discussion

We will now revisit our hypotheses in the light of the findings in Section 5.1. Our first hypothesis suggested that higher levels of democracy would lead to higher levels of per capita household electricity consumption. The bivariate, cross-sectional analysis revealed that there is a non-linear relationship between level of democracy and household electricity consumption. This is in line with other studies showing a non-linear relationship between level of democracy and states' administrative capacity (Bäck and Hadenius, 2008).

The expectation with regard to the second hypothesis was that better corruption control (i.e. lower levels of corruption) would be associated with higher per capita household electricity consumption. This hypothesis was supported in the bivariate, cross-sectional analysis, which revealed a significant positive relationship between control of corruption and household electricity consumption.

However, both the (non-linear) relationship between level of democracy and electricity provision, and the (linear) relationship between control of corruption and electricity provision, show up only in the cross-sectional model. When we apply a tougher test of the hypothesis, investigating effects of *changes* in levels of democracy and corruption control during a specific time period, the results are non-significant with regard to these hypotheses. We would however caution against disregarding the hypotheses altogether. Recall that the time-series model only takes into account the variation that exists within countries, over time, during the specific time period used. Any developments outside of this time period–which eventually accumulates to large differences between countries–are not taken into account. We would therefore recommend further testing, and when possible extending the time period under study.

Because it is a tough test, it is all the more interesting that our third hypothesis turns out to be supported by the time-series model. To reiterate, we expected that the effect of democracy on per capita household electricity consumption would depend on the level of corruption in SIDS, in the sense that the positive effect of democratization would be weaker in contexts with widespread corruption. The interaction effect between levels of democracy and corruption control in SIDS–is indeed shown to matter for explaining the developments within countries over time. Democratization has positive effects on the provision of electricity to the general population *only* when there is a certain level of corruption control in place. When there is widespread corruption, democratization has no, or even a negative, effect on electricity provision to the households in SIDS. These findings add to our knowledge on the political determinants of electricity provision by emphasizing that the implementation process enhances our understanding of the role that democratic institutions play for the provision of electricity.

6. Conclusions and policy implications

In this paper, we have investigated the independent and interdependent effects of level of democracy and control of corruption on per capita household electricity consumption in SIDS. The aim has been to contribute to our understanding of how regime type and the quality of implementing institutions in the political system affect the prerequisites for successful electrification in SIDS.

The results show that although the independent effects of level of democracy and control of corruption are sensitive to model specification, these two factors have an interdependent impact on per capita household electricity consumption. In other words, democratization has positive effects on provision of electricity to the general population only when there is a certain level of corruption control in place. When there is widespread corruption, democratization has no, or even a negative, effect on electricity provision to the households in SIDS.

Before turning to the implications of our results, we would once again like to point out that while our analysis shows how level of democracy, control of corruption and household consumption of electricity are correlated, future research should aim at establishing the causal links between these factors more firmly. Improved indicators of different aspects of governance, as well as indicators more accurately capturing people's access to electricity, would certainly be a welcome contribution. Additionally, we would like to highlight the need for case studies in which the suggested causal mechanisms can be examined directly; for example, case studies focusing on the role of public good provision in the evaluation of political candidates in SIDS.

The finding that democracy only has a positive effect on electricity provision in SIDS under certain conditions must not imply that democracy is unimportant, or that we should focus less on further democratization in SIDS. On the contrary, our results show that once a certain level of corruption control is in place, democracy does have a positive effect. Moreover, normatively speaking, democracy has many intrinsic values that may be as important as its direct impact on public good provision.

In addition, there are other implications of our study that should be of interest for scholars and policy actors. First, we need to be aware of how democratic accountability institutions and implementing institutions interact in delivering public goods to the people. Reforms to enhance public good provision through strengthening the procedural part of the political system in a country–such as electoral reforms–may fail if there is no attempt to also deal with existing problems in the bureaucracy, such as widespread corruption. Democratic accountability and control of corruption need to be promoted together, to achieve wished-for outcomes for public good provision. Second, we should have more realistic expectations on democracy in terms of its direct and immediate effects on public goods provision. Finally, when planning electrification projects, it is necessary to have information not only about potential sources of energy, infrastructure or the technical aspects of the electrification process, but also about the social and political context (Sovacool, 2014a, 2014b). To design the most effective projects, policy actors should be aware of the specific institutional challenges of the context in which they are operating. Policies aimed at fulfilling the general demand for electricity probably need to be designed differently depending on the political and institutional contexts. In cases where the institutional framework is unfavourable for electrification, actors that wish to engage in electrification efforts may not be able to rely on the usual toolbox. For example, previous research implies that when there are low levels of generalized trust in society–a common feature of contexts driven by corruption–policy instruments need to be adjusted to be seen as legitimate (Harring, 2014, 2015).

Our results show that an especially challenging context for electrification could be when democratization is taking place within a very corrupt setting. However, recent qualitative research has revealed that under certain circumstances, electrification projects that involve the building of democratic structures can be

[12] This level can be comparable with the level of corruption control in Haiti, DR Congo and Somalia in 2005.

[13] The cases where control of corruption takes values below −1 include Solomon Islands in 2002–2003, Comoros in 1998 and 2000, Haiti throughout the whole time period and Papua New Guinea in 2004–2009.

successful even in a context with a challenging institutional framework in terms of corruption. However, this requires that the project has a strong focus on the institution building part of the electrification process and thus calls for longer time horizons in implementing the project (Ahlborg, 2015).

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Appendix A

(Fig. A1 and A2).

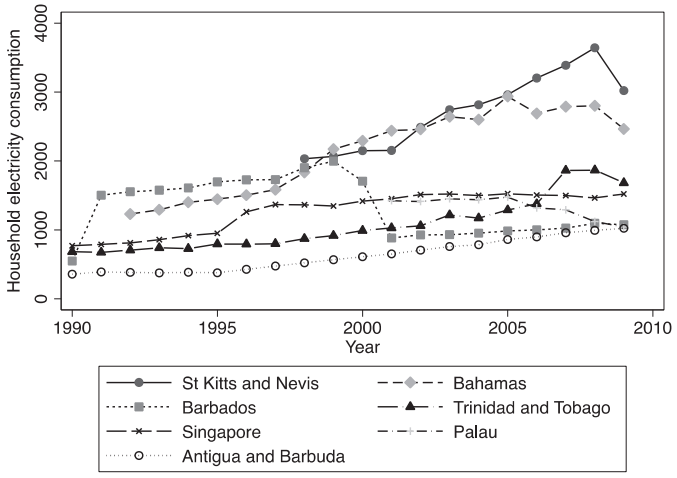

Fig. A. 1. Per capita household electricity consumption (kWh): Selection of SIDS that have succeeded in providing increased household electricity access. Source: United Nations (2013).

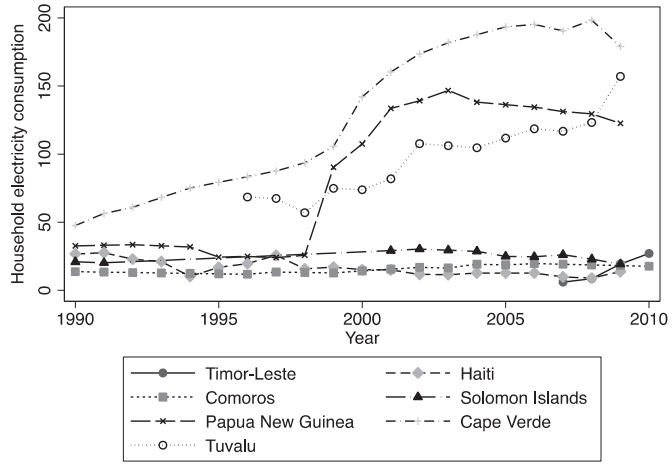

Fig. A.2. Per capita household electricity consumption (kWh): Selection of SIDS that have not succeeded in providing increased household electricity access and which have recently started to develop.

Appendix B

(Table B1).

Table B.1
Classification of SIDS used in the analysis according to the level of democratic development and control of corruption in 2009.[14]

		Democracy level		
		High (above 7.5 on 0–10 scale)	Medium (between 5 and 7.5)	Low (Below 5 on 0–10 scale)
Control of Corruption	High (above 1 on –2.5 to 2.5 scale)	Antigua and Barbuda Bahamas Barbados St Kitts and Nevis St Lucia St Vincent and Grenadines		Singapore
	Medium (between 0 and 1 on –2.5 to 2.5 scale)	Cape Verde Dominica Grenada Mauritius Vanuatu Samoa	Seychelles	Bahrain Cuba
	Low (below 0 on –2.5 to 2.5 scale)	Belize Comoros Dominican Republic Kiribati Guyana Jamaica Micronesia Palau Sao Tome and Principe Suriname Trinidad and Tobago Tuvalu	Solomon Islands Haiti Maldives Papua New Guinea Timor-Leste	Fiji

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[14] We use the year 2009, despite the data on democracy and corruption being available for later years, because in our regression sample later on, it is the last year for which the dependent variable–household electricity consumption–is available.

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